ENVIRONMENTAL HAZARD MANAGEMENT PLAN

43 Ahui Street
Honolulu, Oahu, Hawaii
TMK (1) 2-1-060: Parcel 013

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November 2010

93519

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1.0 CERTIFICATIONS AND LIMITATIONS

EnviroServices & Training Center, LLC (ETC) has completed this Environmental Hazard Management Plan (EHMP) for the property located at 43 Ahui Street (see Figure 1). The findings and conclusions contained herein are professional opinions based solely upon visual observations and interpretation of the historical information and documents available to ETC at the time this EHMP was prepared.

This report is intended for the sole use of the Client, Ocean Investments LLC, exclusively for the project site indicated. The scope of services performed in execution of this project may not be appropriate for satisfying the needs of other users, and any use or reuse of this report or the findings and conclusions presented herein is unauthorized and at the sole risk of said user.

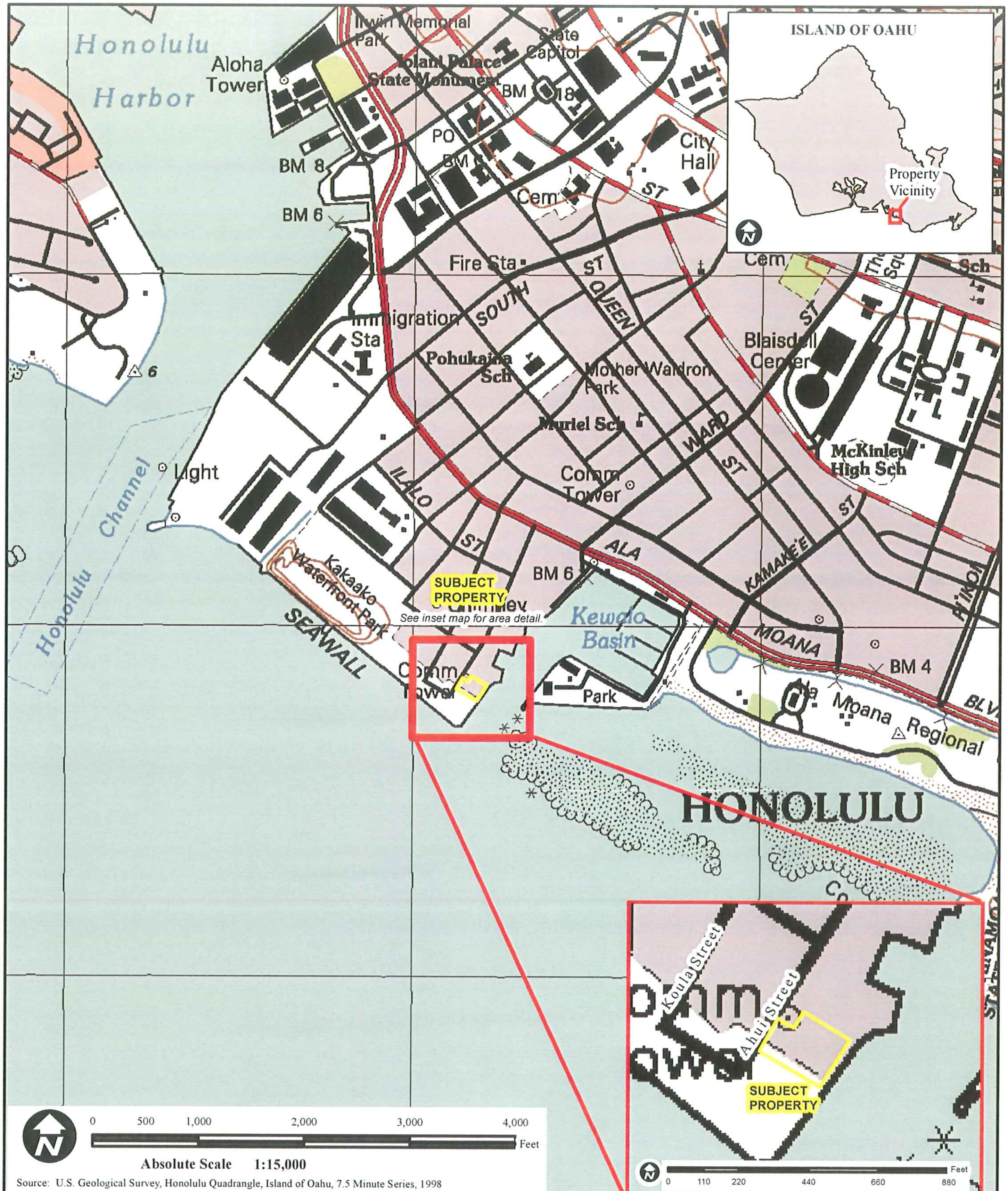
ETC makes no guarantee or warranty; either expressed or implied, except that our services are consistent with good commercial or customary practices designed to conform to acceptable industry standards and governmental regulations. No warranty or representation, expressed or implied, is included or intended in its proposal, contracts, or reports. Opinions stated in this plan apply only to the site as outlined and apply to the conditions present at the time of the project. Moreover, these opinions do not apply to future site changes.

2.0 INTRODUCTION/PURPOSE

EnviroServices & Training Center, LLC (ETC) was retained by Ocean Investments LLC (OI) to prepare this Environmental Hazard Management Plan (EHMP) for the property located at 43 Ahui Street and designated as Tax Map Key (TMK) (1) 2-1-060: Parcel 013.

A recent investigation at the site included the collection of multi-increment samples representing three different soil layers across the entire parcel. Details of the investigation and identification of the associated environmental hazards are provided in the October 2010 *Site Investigation Report and Environmental Hazard Evaluation* (SIR-EHE) prepared by ETC for OI. The contaminants of potential concern (COPC) targeted in the investigation included total petroleum hydrocarbons (TPH) as diesel (TPH-D), TPH as oil (TPH-O), polynuclear aromatic hydrocarbons (PAHs), organochlorine pesticides, and the metals arsenic, barium, cadmium, chromium, copper, lead, mercury, selenium, silver, and zinc. These COPC were selected based on the suspected contaminant source – historic filling operations from former municipal waste incinerators in the area.

The environmental hazard identified for the planned commercial land use at the site was the direct exposure hazard associated with benzo(a)pyrene and lead in soils at depths between 2- and 8-feet below ground surface (bgs). This EHMP was prepared to document the extent and magnitude of the contaminated soil at the site, summarize the potential environmental hazards associated with the contamination, and provide details for the long term management of the contamination during site construction and future site operations.



EnviroServices & Training Center, LLC

Project No. 10-2017

November 2010

Figure 1 - Site Location Map

Environmental Hazard Management Plan
43 Ahui Street
Honolulu, Oahu, Hawaii

3.0 SITE BACKGROUND

3.1 Site Description and Land Area

The Property consists of approximately 37,241 square feet (0.885 acres) of commercial waterfront land located at 43 Ahui Street and falls within the Kakaako Community Development District (also referred to as the Kakaako Makai District) in Honolulu, Hawaii (see Appendix I, Figure 1). The Hawaii Community Development Authority, an agency of the State of Hawaii, is the current landowner and Ocean Investments, LLC has been the lessee since October 2007 and holds the lease rights for the Property through December 22, 2042. Prior to 2007, the Property was leased by Basin Project Inc., the entity that developed the current structures.

Currently, the John Dominis Restaurant occupies the site. The facility consists of two commercial structures, the restaurant with adjoining multi-purpose facility and a two-story office, with an existing floor area of 18,654 square feet. The John Dominis Restaurant/multi-purpose facility structure has an irregular shape that cantilevers approximately 40 feet out over the channel water within an air rights easement. The remaining areas of the site consist of an asphalt paved parking lot and landscaping.

The Property is relatively flat with a slight gradient towards Ahui Street and is situated at an elevation of approximately 10 to 12-feet above mean sea level (msl). Areas adjacent to the Property include a 3,600 square foot parcel abutting the northwestern corner leased to Salem Media of Hawaii with an approximate 300-foot tall broadcasting tower, the University of Hawaii's Pacific Biosciences Research Center (PBRC) adjacent to the south, and other former commercial/industrial lots that are currently vacant.

3.2 Climatologic Conditions

The main features of Oahu's climate include mild temperatures throughout the year ranging from 88°F (31°C) to 74°F (23°C) and moderate humidity of 53% during the day. The northeasterly trade winds generated by a high pressure center north of the islands are the dominant factor that governs the climate in Hawaii. Two mountain ranges on Oahu, the Koolau Mountains which extend along the northeastern side of the island and the Waianae Mountains which extend along the southwestern side of the island, influence every aspect of the climate. Both mountain ranges serve to block the trade wind moisture and as a result, showers occur almost daily on the windward side while on the leeward side showers are light. The trade winds are generally strongest during the summer (May through October) and are periodically disrupted by storms in the winter (October through April), which result in heavy rain and thunderstorms throughout the island. At the site, the average annual rainfall reported by the U.S. Department of Agriculture is between 10 to 40 inches, most of which occurs during the winter months.

3.3 Site Geology

Oahu is formed by the erosional remnants of two shield volcanoes. These are the Waianae range to the west and the Koolau range to the east. The Waianae volcano is estimated to have formed 2.4 to 3.6 million years before present. It consists of a tholeiitic lava shield with a thick cap of transitional to alkalic rock. Rejuvenation-stage volcanics of undifferentiated age occur in Kolekole Pass and on the south flank of the Waianae shield. Dike orientations define northwest and southwest rift zones (Macdonald, et al., 1983).

The Koolau volcano is estimated to have formed 1.8 to 2.6 million years before the present (Macdonald, et al., 1983). It consists of a tholeiitic lava shield and lacks an alkalic cap. It has well defined major dike complex trending northwest-southwest. A third, minor rift zone referred to as the Kaau rift trends southward from Kaau crater, near the upland crest of the Koolau Ridge. After a long dormant period and periods of deep erosion, the Koolau volcano developed abundant and scattered rejuvenation-stage vents, typically aligned on northeast-striking fissures (Macdonald, et al., 1983).

The soil at the property is mapped as mixed fill land, which consists of areas filled with material dredged from the ocean or hauled from nearby areas, garbage, and general material from other sources. Fill land occurs primarily near Pearl Harbor and in Honolulu, adjacent to the ocean. Average annual rainfall in the area is less than 200 cm per year. This land type is generally used for urban development including airports, housing areas, and industrial facilities (USDA, 1972).

As further described in Section 3.6, prior to 1913, the southern coastline of Honolulu generally followed the present location of Ala Moana Boulevard. Artificial fill was used to expand the coastline seaward starting in 1913. Artificial fill used to create the current property included municipal waste and municipal incinerator ash.

Physical observations made during boring advancement activities indicated that soil at the site is consistent with fill land, with various soil types observed. In addition, layers of suspect incinerator ash and ash-related materials were observed throughout the project site in soil cores obtained during sample collection.

3.4 Site Hydrogeology

The primary drinking water in the Hawaiian Islands is drawn from basal groundwater. Basal groundwater is formed by rainwater percolating down through the residual soils and permeable volcanic rock. The portion of the island situated below sea level, except within rift zones of the volcanoes, is saturated with ocean salt water and thus forms a basal lens called the "Ghyben-Herzberg" lens. A zone of transition between the fresh groundwater and the ocean salt water occurs due to the constant movement of the interface as a result of tidal fluctuations, seasonal fluctuations in recharge and discharge and aquifer development (Macdonald, et al., 1983).

Downward percolation of rainwater may be stopped by impermeable layers such as dense lava flows, alluvial clay layers and volcanic ash. The groundwater then forms a perched or high level aquifer, which is not in contact with salt water. Recharge of the aquifer occurs in areas of high rainfall, which are the interior mountainous areas. The groundwater flows from the recharge areas to the areas of discharge along the shoreline. Frictional resistance to groundwater flow causes it to pile up within the island until it attains sufficient hydraulic head to overcome friction. Thus, basal groundwater tends to slope toward the shoreline.

According to Mink & Lau, 1990, the property is underlain by the Nuuanu Aquifer System, which is part of the Honolulu Aquifer Sector on the island of Oahu. The aquifer is classified with the system identification number 30102116 (13321). This system includes an unconfined basal aquifer in sedimentary (nonvolcanic) lithology. The groundwater in this aquifer is described as being currently used as well as ecologically important, but is not a direct drinking water source. The groundwater contains a moderate salinity (1,000 to 5,000 mg/l Cl^-) and is described as replaceable with a high vulnerability to contamination (Mink and Lau, 1990). The site is further underlain by a second aquifer of the same system. The aquifer is a confined, basal aquifer in flank compartments, and is classified with the system identification number 30102121 (11113). The lower aquifer is described as a currently used drinking water source containing groundwater with a fresh salinity (<250 mg/l Cl^-). It is described as irreplaceable with a low vulnerability to contamination (Mink and Lau, 1990).

A previous geotechnical engineering soil investigation identified groundwater at depths ranging from 7.75 feet below ground surface (bgs) to 13.25 feet bgs. The depth to groundwater could not be definitively measured during the most recent site investigation.

3.5 Surface Water Bodies/Drinking Water Wells/Ecological Habitats

The nearest surface water bodies are the Kewalo Basin, located adjacent and to the east, which is contiguous with Mamala Bay. Review of the underground injection control (UIC) line maps and the August 26, 1993 *Hawaii Ground Water Index and Summary* indicated that the property is located approximately 0.25 to 0.5 miles below the UIC line. The closest drinking water wells, 1849-10, 1849-13, 1849-14, 1849-15, and 1849-16 are located above the UIC line approximately 1.75 miles east of the site. There are no wells located downgradient of the site and the land use of the neighboring properties is recreational and commercial/industrial. No ecological habitats were identified at the property. However, the adjacent Kewalo Basin and Mamala Bay support coral reefs and local bird populations.

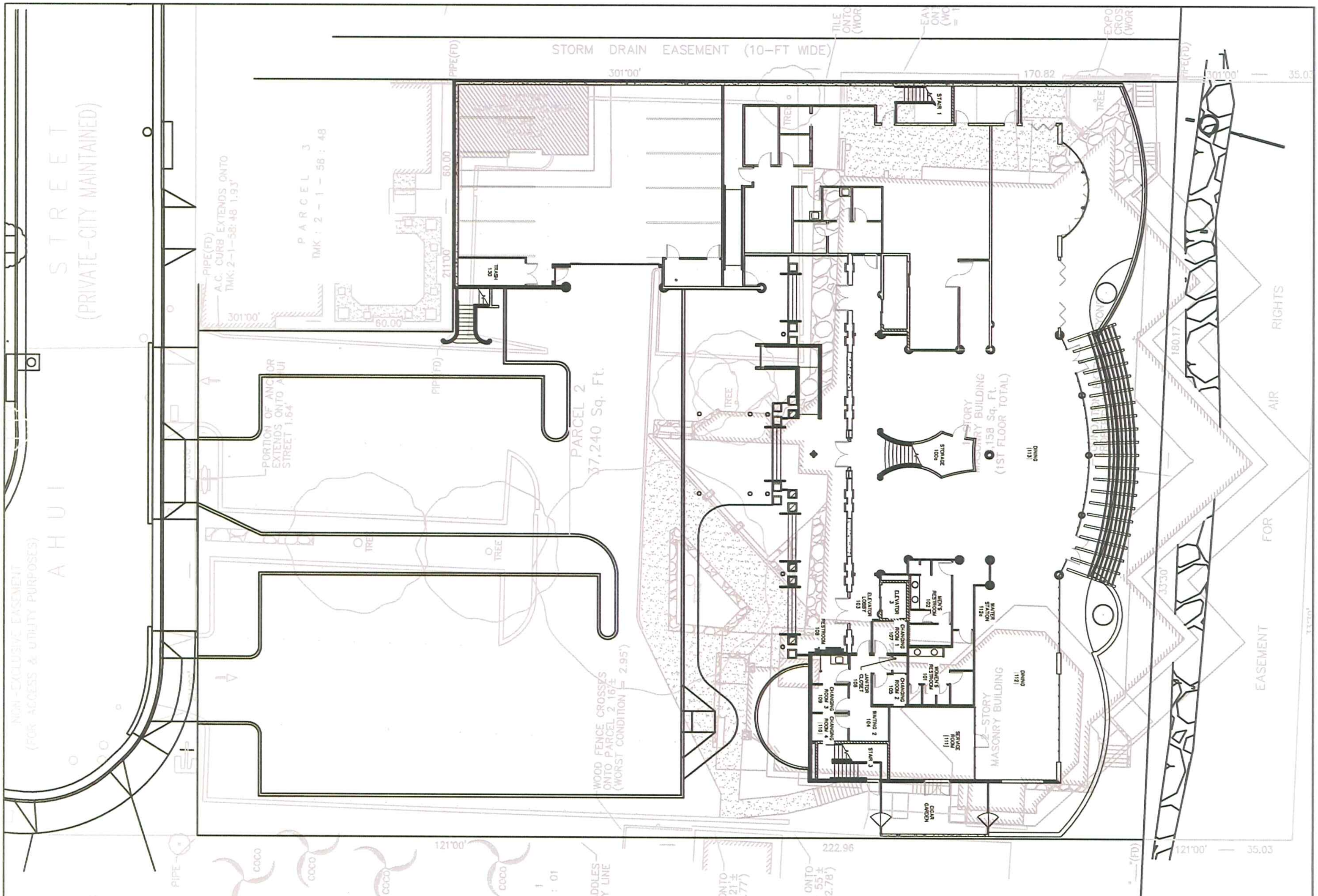
3.6 Historical Land Use

The original southern coastline of Honolulu generally followed the present location of Ala Moana Boulevard and the Kakaako Makai District was previously situated at or below sea level. Between 1913 and 1927, a seawall was constructed and artificial "fill" materials were deposited behind the seawall. The fill material consisted of ash from the burning of municipal refuse, unburned refuse, construction debris, household debris, automobile batteries, and other miscellaneous refuse items. The deposited fill material caused the coastline to move south and thereby established new land for development in the Kakaako Makai District. In 1930, the first of two incinerators was built on the southeast portion of Ahui Street. In the mid 1940's, a second incinerator was also constructed in the area (Noda and Cotton, 1997). From the late 1940's until the 1960's, land areas seaward of both incinerators were expanded to the south with fill material and ash from the incinerators.

The first record of development on the site was in 1978, when the current John Dominis Restaurant was constructed. There has been no other documented use of the property.

3.7 Current and Future Land Use

Currently, the property is used as a restaurant and multi-purpose facility. Plans for future development will maintain the use of the property as a restaurant and multi-use assembly and hospitality facility. Due to the age and existing condition of the structures, renovation for long term use has been deemed economically infeasible. A site plan depicting the planned replacement structure is provided in Figure 2. This plan shows the outline of the existing structures and the floor plan for the new, replacement structure.



15' 0' 15' 30'

Graphical Scale: 1" = 30'
Note: Original Sheet Size is 8.5x11, For All Other Sizes Scale Accordingly

Source: Hida Okamoto & Associates, Inc.

EnviroServices & Training Center LLC

Project 10-2017

November 2010

Figure 2 - Planned Development
Environmental Hazard Management Plan
43 Ahui Street
Honolulu, Oahu, Hawaii

4.0 CONTAMINANTS OF CONCERN

The COPC targeted during the recent site investigation included TPH-D, TPH-O, PAHs, organochlorine pesticides, and certain heavy metals. Through review and evaluation of analytical data in comparison to appropriate DOH EALs, the resultant contaminants of concern (COC) were identified in the SIR-EHE as benzo(a)pyrene and lead. Mean concentrations of benzo(a)pyrene and lead in soil throughout the property at depths of 2- to 8-feet bgs exceeded the DOH EALs for direct exposure hazards at sites planned for commercial/industrial land use.

Although not considered to be a significant environmental hazard, copper and zinc concentrations in soils at depths of 2- to 8-feet bgs also exceeded the DOH EALs associated with terrestrial ecotoxicity hazards. The primary concern regarding copper and zinc is associated with sediment runoff into the adjacent Kewalo Basin and/or Pacific Ocean, particularly during site construction, rather than any potential impacts to terrestrial ecological receptors. This concern would be most prevalent during site development activities. Addressing the direct exposure hazards identified in subsurface soil at the site will in turn address potential sediment runoff concerns posed by elevated copper and zinc concentrations. Therefore, no specific controls would be warranted to directly address terrestrial ecotoxicity hazards.

5.0 CONCEPTUAL SITE MODEL

A conceptual site model (CSM) provides a generalized framework regarding site-specific conditions relevant to potential contaminants, contaminant sources, migration pathways, routes of exposure, potential receptors, and environmental hazards (i.e., leaching to groundwater/ discharge to surface waters, ecological toxicity) that may be affected by the contaminants. Establishment of this framework is essential for assessing environmental hazards associated with the contaminants, determining what receptors are at risk, determining appropriate remedial strategies, and addressing unacceptable hazards.

The following environmental hazards were initially considered:

- Direct exposure threats to human health;
- Intrusion of subsurface vapors into buildings;
- Leaching and subsequent threats to groundwater resources;
- Threats to terrestrial habitats; and
- Gross contamination and general resource degradation concerns.

The primary source of contamination suspected at the property was the historic use of municipal waste and municipal incinerator ash as fill.

Based on review of analytical data and comparison to appropriate DOH EALs, the primary environmental hazard identified for this site was direct exposure threats to human health associated with elevated benzo(a)pyrene and lead concentrations in subsurface soils.

5.1 Potential Receptors

When identifying potential receptors, plausible exposure under both current and future land use was evaluated. Accordingly, potential receptors were identified for both current and future use scenarios.

Future Site Users

Current plans identify continued commercial use of the property. In 2006, the State of Hawaii mandated by law that the Kakaako Makai District could not be used for residential purposes (Hawaii Revised Statutes §206E-31.5). As such, future use of the property will remain restricted to non-residential purposes and should be taken into consideration when identifying potential receptors.

Site Construction Worker

Current plans include the development of the site. As a result, the construction worker would be present during development. It is assumed that construction workers could be exposed to contaminated soil.

Aquatic Ecological Receptors

Due to the proximity of the site to the Kewalo Basin, aquatic ecological habitats may be impacted by contaminants through sediment runoff that may enter surface waters.

Other Off-Site Receptors

One of the primary concerns associated with potential contaminated soil at the site is management of any soil that may be excavated for foundation construction, underground utility installment/maintenance, and/or other activities that may create excess soil. If not managed properly, such soil may be inadvertently used at sites where restrictions on residential use are not applicable.

5.2 Exposure Pathways

Exposure is defined as the contact of an organism with a chemical or physical agent. An exposure pathway is defined as "the course a chemical or physical agent takes from a source to an exposed organism." It describes "a unique mechanism by which an individual or population is exposed to chemicals or physical agents at or originating from a site (USEPA, 1989)." In order for an exposure pathway to be considered potentially complete, four elements must exist: 1) a source or release from a source; 2) a transport/exposure media; 3) an exposure point (point of contact with the contaminated medium); and 4) an exposure route. The potential exposure pathways present at the property are described below.

5.2.1 Soil Exposure Pathway

Direct contact with soil may result in incidental oral ingestion and/or dermal absorption of COC. Although generally associated with surface soil, direct contact may also occur with subsurface soil during trenching and excavation work.

5.2.2 Air Exposure Pathway

Air exposure pathways become potential routes of exposure at this site when COC enter the air via adsorption to fugitive dust particles. Generation of fugitive dust may occur through disturbance of affected soil, such as wind or construction activities. Dust particles may be inhaled, may settle on human skin and be ingested (hand to mouth), and/or may settle on vegetation that may be ingested by humans.

5.2.3 Sediment Exposure Pathway

Receptors may be exposed to COC in sediment as a result of surface runoff during storm events. Sediment may accumulate in the adjacent marine environment and be available for contact with various receptors. Recreational users of the marine environment (swimmers, surfers, fishermen) may come into direct contact with sediment and be exposed through oral ingestion and/or dermal absorption. Ecological receptors may live directly in the impacted sediment and may be exposed to COC through feeding within the sediment. As a secondary transport mechanism, COC may bioaccumulate in ecological receptors (i.e., fish, shellfish), then be ingested by human receptors.

6.0 SUMMARY OF ENVIRONMENTAL HAZARDS

This section summarizes the environmental hazards that exist at the project site based on data from the site investigation and the environmental hazard evaluation. As described in the SIR-EHE, the retained environmental hazard for the site is the direct exposure hazard resulting from elevated benzo(a)pyrene and lead concentrations in soils at depths of 2- to 8-feet bgs associated with commercial/industrial land use.

Although not considered to be a significant environmental hazard, copper and zinc concentrations in soils at depths of 2- to 8-feet bgs exceeded the DOH EALs associated with terrestrial ecotoxicity hazards. The primary concern regarding copper and zinc is associated with runoff of COC-impacted sediment into the adjacent Kewalo Basin and/or Pacific Ocean, particularly during site construction, rather than any potential impacts to terrestrial ecological receptors. This concern would be most prevalent during site development activities. Addressing the direct exposure hazards identified in subsurface soil at the site will in turn address potential sediment runoff concerns posed by elevated copper and zinc concentrations. Therefore, no specific controls would be warranted to directly address terrestrial ecotoxicity hazards.

Consideration must also be given to any soil (surface or subsurface) that is excavated at the site. Although the environmental hazards associated with contaminants in the site soil may be limited if the soil remains undisturbed, this assumption cannot be made for soil that is exhumed. Appropriate management of such excavated soil will be necessary.

7.0 ENGINEERING AND INSTITUTIONAL CONTROLS

Engineering and institutional controls are often used to mitigate environmental hazards by separating the residual COC in soil and/or groundwater at a site from potential receptors, thus breaking the exposure pathways.

Current development plans for the project site include the replacement of the current structure and construction of a parking lot of similar size to the existing, with limited landscaped areas. As such, the site features will serve as a "cap" over the existing contaminated soils. The building foundations and parking lot will create a physical barrier to break the direct exposure pathway between future surface receptors and the underlying benzo(a)pyrene and lead contaminated soil. In addition, site features will minimize or prevent future runoff of sediment into the adjacent Kewalo Basin or into the storm sewer system during storm events.

No institutional controls are currently required for the site since there is a prohibition against development for residential use within the Kakaako Makai District. However, appropriate management of any soil excavated from the site will need to be implemented.

7.1 Long-Term Monitoring and Preventive Maintenance of Engineered Controls

Routine upkeep of the asphalt parking area and the landscaped areas will be required to prevent potential breaches and establishment of exposure pathways. This may include inspecting and sealing cracks in the asphalt as well as other general maintenance procedures. Any future construction at the site, such as utility line installation/repair, should take into consideration the function of the cap in containing environmental hazards associated with the COC.

7.2 Breach or Failure of Engineered Controls

The future site structures and asphalt parking area will act as barriers between future surface receptors and the direct exposure hazard existing in subsurface soil at approximately 2 feet below ground surface. A breach of the barriers could potentially occur during future construction activities that disturb the underlying soil. Such a breach may create a direct exposure pathway for contaminants in the soil to potential receptors. If such activities are planned, the measures described in Section 8.0 should be used to minimize exposure risks.

Furthermore, removal or breaches in the caps may allow COC particles to accumulate in surface runoff, which may then enter surface water bodies either directly (runoff from adjacent shorelines) or through the existing storm drain system. Care should be taken to avoid exposure of existing site soils to minimize and/or eliminate this potential occurrence.

The aquatic habitats in Kewalo Basin and Mamala Bay may also be impacted if construction activities at the site require dewatering activities. If feasible, any dewatering effluent should be maintained within the site (pumping from one trench to another). If off-site discharge of dewatering effluent is required, representative samples of the effluent should be collected and analyzed to determine COC concentrations prior to any discharge activities. Treatment of dewatering effluent may be required to remove COC prior to discharge.

8.0 SOIL AND GROUNDWATER MANAGEMENT FOR FUTURE SITE ACTIVITIES AFFECTING ON-SITE CONTAMINATION

While the current plans for site development will create a barrier between future surface receptors at the site and the existing direct exposure hazard in subsurface soils, interim controls will be needed to address potential exposures during upcoming construction activities and during any future construction work that may disturb subsurface soils. The following describes measures that should be implemented during such construction activities to minimize exposure risks.

8.1 Pre-Excavation Evaluation of Soils

Planning for construction activities that may disturb subsurface soils is a key factor in minimizing exposure risks and avoiding migration of COC. Any contractor performing earthwork should be made aware of the COC existing in site soils (identified during the site investigation), including those COC in the soil that have concentrations below commercial/industrial EALs but exceeding unrestricted EALs. A summary of these COC is provided in Table 1 below (note that a more complete table showing actual mean contaminant concentration values can be found in the SIR-EHE document).

The COC provided in Table 1 are important factors in determining handling of excavated soil. If the soil needs to be disposed off-site, plans should be made to characterize the excavated soil prior to transportation and for identifying an appropriate receiving facility. Depending upon the receiving facility's requirements, additional analytes may be requested.

If plans are being made for excavated soil to be used on-site, then such soil should be placed at depths of at least 12 inches below ground surface (if soil cover above) or beneath a relatively impervious surface (e.g., asphalt, concrete).

Although the leaching to groundwater hazard in soil was not considered to be a significant concern in the SIR-EHE, alteration of the existing conditions may preclude these findings and therefore, the leaching hazard must be considered when planning for excavated soil.

Table 1: Potential Environmental Hazards Associated with Excavated Soils

COC	Hazards - Unrestricted			Hazards - Commercial/Industrial		
	DE	TE	LE	DE	TE	LE
TPH-O			X			X
Benzo(a)anthracene	X					
Benzo(a)pyrene	X*			X		
Benzo(b)fluoranthene	X					
Dibenzo(a,h)anthracene	X					
Indeno(1,2,3-cd)pyrene	X					
Copper	X	X			X	
Lead	X	X*		X		
Zinc		X			X	
4,4'-DDE	X					
4,4'-DDT	X					
Aldrin	X					
Dieldrin	X		X*			X*
Endosulfan I			X			X
Endrin			X			X
Endrin aldehyde			X*			X*
Endrin ketone			X			X
Heptachlor epoxide			X*			X*
Toxaphene	X					

The environmental hazards described above pertain to soil at depths of 2 feet below current, existing grade, unless noted otherwise.
DE = direct exposure hazard
TE = terrestrial ecotoxicity hazard
LE = leaching hazard
* = Environmental hazard exists for surface soil (0- to 2-feet below current existing grade)
TPH-O concentrations in surface and subsurface soil also pose a gross contamination hazard for unrestricted land use scenarios.

8.2 Erosion Control Measures

Erosion control measures should be established prior to commencement of any earthwork activities to prevent site soils from migrating via surface water runoff into adjacent roadways, drainage systems, and/or surface water bodies. The contractor should be responsible for determining whether certain permits associated with site grading and/or stockpiling are appropriate (i.e., National Pollutant Discharge Elimination System [NPDES], County grading/stockpiling permits, etc.) and whether an erosion control plan is necessary. Typically, Best Management Practices (BMPs) associated with erosion control measures are designed to ensure that soil from a site are retained on site and prevented from ultimately entering surface water bodies. Such BMPs may include (but are not limited to) installation of a silt fence along the site perimeter, physically redirecting potential storm water runoff from leaving the site, and/or installation of controls to prevent tracking of dirt and debris off-site on vehicle tires.

8.3 Dust Control

Standard procedures to minimize dusty conditions, such as spraying water on the soil, should be utilized at the site by the contractor. Dust barriers should be constructed along the perimeter of the site if extensive earthwork is anticipated. Controlled spraying of the area with water to suppress dust migration during any soil disturbance work should be conducted during any earthwork activities. The contractor should ensure that throughout the construction process, work at the site does not cause significant deterioration of existing air quality. Specifically, the Contractor should ensure compliance with ambient air quality standards established in Hawaii Administrative Rules (HAR) 11-59 and should comply with air pollution control requirements specified in HAR 11-60.1, at a minimum.

8.4 Soil Excavation and Handling

Construction activities should be structured to result in minimal soil disturbance and to minimize dust generation. When excavation of site soils is necessary for development, activities should be sequenced to minimize the potential for exposure of site workers. As an example, all earthwork (trenching for utilities, site grading, etc.) should be performed prior to mobilization of other trade personnel to minimize the number of workers at the site that may be exposed to airborne particulates.

Another control that can be implemented to isolate contaminated soils during construction activities is to place a barrier on or along exposed soils, such as lining the walls of an open trench with polyethylene sheeting or placing a thin layer of clean, imported fill material immediately after completing foundation excavations.

If excavated soil needs to be transported, whether on-site or off-site, controls should be implemented to minimize the generation of fugitive dust. This may include spraying water on loads of excavated soil or covering truck loads with fabric.

8.5 Soil Stockpiling and Storage

Any excavated soil that needs to be stockpiled on-site temporarily should be placed on a minimum 10-mil thick layer of polyethylene sheeting in a designated stockpile area. All stockpiles should then be covered using minimum 6-mil thick polyethylene sheeting. The covering should be secured with inert material (i.e., clean, imported fill; etc.) to anchor the polyethylene cover to the stockpile and to prevent the cover from being blown off during high wind conditions. The edges of the stockpile should then be secured to prevent run-on of storm water or run-off of soil particles. This can be accomplished by rolling the edges of the polyethylene liner and the polyethylene cover together and securing the rolled ends with heavy, inert materials. Alternatively, a berm can be constructed around the soil stockpile using clean, imported fill material.

8.6 Soil Disposal

If feasible, excavated soils should be used on-site. Such soil should be placed under paved surfaces (concrete foundations, asphalt paving) when possible. At a minimum, soils excavated from the site should be placed under a 12-inch thick clean soil cap with some type of permeable marker (e.g., geotextile fabric) used to identify the interface between the contaminated soil and the clean, imported soil cap. The soil cap will need to be monitored periodically to ensure the integrity of the cap.

If development plans require the off-site disposal of excavated soil, such soil will need to be sufficiently characterized and information will need to be provided to the government-permitted disposal facility. The disposal facility will have the discretion of accepting or rejecting the overburden soil.

8.7 Groundwater Handling and Disposal

Although groundwater was not considered to be a significant issue if left undisturbed, any work requiring dewatering may require specific management to prevent the release of untreated groundwater to surface water bodies. If possible, groundwater should be retained on-site rather than being discharged or disposed off-site. This may be accomplished through construction of groundwater discharge trenches or other means.

If discharge of groundwater off-site is necessary, the contractor will need to obtain the appropriate permits (i.e., NPDES, discharge permits, etc.) prior to release. The contractor will ensure that the groundwater being discharged has been sufficiently characterized and that any contaminants in the groundwater meet applicable threshold criteria (e.g., surface water quality standards, etc.). Should characterization of groundwater indicate elevated contaminant concentrations, groundwater may need to be treated on-site (i.e., settling, mechanical filtration, etc.) or disposed at a government-approved facility.

9.0 EXPOSURE MANAGEMENT

Exposure to contaminated soils and groundwater during construction can generally be controlled by isolating the contaminated media, eliminating routes of exposure and/or eliminating the exposure point. Exposure management can be accomplished by implementing the controls during the construction phase. Examples of such exposure controls are provided below.

9.1 Awareness and Training for Contamination Managed On-Site

OI should advise future workers at the facility about the residual COC present in subsurface soils at the site and that any future earthwork should take this EHMP into consideration.

9.2 Construction Worker Notifications and Protections

All construction workers who will have contact with soils and groundwater should be educated on the site conditions and potential risks associated with contaminants found at the site. In particular, workers should be aware of the COC for the site and the hazards the COC pose. In addition, workers should be aware that routes of exposure to the COC are generally via inhalation of airborne particulates, ingestion of soil, and absorption through the skin and eyes.

A common method of informing construction personnel of potential exposure risks is to prepare a Site Safety and Health Plan (SSHP). The SSHP should describe the contaminants of concern, routes of exposure, and potential symptoms of exposure. The plan should also describe personal protection measures, controls, and work practices to minimize the risk of exposure. Construction personnel should be required to review the SSHP and certify that they have reviewed the plan and understand the risks involved with the project.

In addition to understanding how to protect oneself, site construction workers should also be made aware of how contaminated soils and groundwater can impact the general public (through migration via air or surface water) and the environment. The importance of implementing controls that are protective of the general public should be emphasized.

9.3 Protections for Site Workers and Guests

To supplement the erosion control, dust control, and exposure prevention measures described in previous sections, possible strategies for ensuring that workers and guests are protected from environmental hazards associated with site contamination are provided below.

9.3.1 Use Restrictions to Protect Site Workers and Guests

Prior to commencing any activities that will potentially disturb contaminated soils, workers should be educated on the existing environmental hazards, the potential environmental hazards associated with disturbed soils, and appropriate management of these hazards. Only trained personnel should be permitted access to the site if contaminated soil is exposed.

9.3.2 Personal Protective Equipment (PPE)

The use of personal protective equipment (PPE) is a key measure used to eliminate the exposure point for site construction workers by placing a physical barrier between the worker and the contaminant. Workers should be provided with the opportunity to don PPE prior to the start of any work requiring disturbance of site soils. Once available, work area air monitoring data can be used to evaluate the adequacy of the selected level of worker protection. The SSHP typically details the specific PPE required during various earthwork activities.

Immediately after leaving the work area, workers should remove PPE and wash their hands and face with soap and water. At no time should workers be allowed to smoke, drink, or eat within the work zone and/or near contaminated soil/groundwater.

9.3.3 Contaminant Detection and Monitoring (Air Monitoring Program)

An air monitoring program may be implemented as the primary contaminant detection and monitoring system. The contractor should be responsible for determining whether air monitoring is prudent and which analyses are to be performed to satisfy U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) requirements and such information should be included in the SSHP. The data obtained from work area air samples can then be used to evaluate the effectiveness of control measures and to determine the appropriate level of personal protection.

In addition, area air monitoring at the project site perimeter may be conducted. Prior to start of earthwork activities, background air samples can be collected at the site to identify baseline air quality data. Throughout the project, air samples may be collected as specified in the SSHP to monitor for contaminant migration through fugitive dust. Data from perimeter monitoring should be used to evaluate the effectiveness of control measures implemented on-site.

9.4 Emergency Response Actions for Chemical Exposure

A general emergency response protocol for benzo(a)pyrene and lead exposure is provided below. These recommendations are based on guidance found in the National Institute of Occupational Health and Safety (NIOSH) Pocket Guide to Chemical Hazards (NIOSH, 2005).

9.4.1 Eye Exposure to Chemicals

In the event that contaminated soil comes into contact with the eyes or skin, the recommended courses of action are to:

- Immediately wash (irrigate) the eyes with large amounts of water, occasionally lifting the lower and upper lids.
- Seek immediate medical attention if irritation persists after washing.

An eye wash station should be available on site during any activities involving the disturbance of contaminated surface soils.

9.4.2 Skin Exposure to Chemicals

In the event that contaminated soil comes into contact with the skin, the recommended course of action is to:

- Immediately flush the contaminated skin with soap and water.
- Immediately remove the clothing and flush the skin with water if contaminants penetrate any clothing.
- Seek medical attention if irritation persists after washing.

Soap and water should be made available for the purpose of washing skin during any activities involving the disturbance of contaminated surface soils.

9.4.3 Internal Exposure to Chemicals

Should contaminated soil be ingested in sufficient quantities over the course of work, the recommended course of action is to seek immediate medical treatment.

9.4.4 Inhalation Exposure to Chemicals

Should contaminated soil be inhaled over the course of work leading to breathing difficulty, the recommended course of action is to:

- Immediately move the exposed person to fresh air.
- Perform artificial respiration if breathing has stopped.
- Keep the affected person warm and at rest.

Seek medical treatment as soon as possible.

10.0 REFERENCES

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